REMARKS

Claims in the case are 1-3 and 5-13, upon entry of this amendment. Claims 1, 5, 8, 9 and 11 have been amended, Claims 12 and 13 have been added, and Claim 4 has been cancelled without prejudice herein.

Support for Claim Amendments and New Claims:

Claim 1 has been amended herein to replace "90°" with --105°--. Support for this amendment to Claim 1 is provided by Claim 5, and the paragraph at lines 20-26 on page 4 of the specification. Claim 5 has accordingly been amended herein to delete recitations of 90° and 105°.

Claim 1 has been further amended herein to include the subject matter of Claim 4. Support for this amendment to Claim 1 is provided by Claim 4, and the paragraph at lines 12-18 on page 4 of the specification. Claim 4 has accordingly been cancelled without prejudice herein.

Claim 9 has been amended herein as to form by deleting recitations of "preferably."

Support for added Claim 12 is provided by Claim 11, and the paragraph at lines 5-6 on page 6 of the specification. The "preferably" recitation within Claim 11 has accordingly been deleted herein.

Support for added Claim 13 is provided by Claim 8, and the paragraph at lines 10-14 on page 5 of the specification. The "preferably" recitation within Claim 8 has accordingly been deleted herein.

Obviousness Rejections Under 35 U.S.C. §103(a):

I. Burgmair et al. in View of Usui et al.

Claims 1-3, 5, 7, 8, 10, and 11 stand rejected under 35 U.S.C. §103(a) as being obvious and unpatentable over Markus Burgmair, Contribution of the Gate Insulator Surface to Work Function Measurements with a Gas Sensitive FET, Proceedings of IEEE Sensors 2002, pp. 439-442 (**Burgmair et al.**) in view of H. Usui et al., Ionization-Assisted Deposition of Alkylacrylate and Fluorinated Alkylacrylate Polymer Thin Films, Proceedings of the 7th

International Conference on Properties and Applications of Dielectric Materials, June 1-5, 2003, pp. 104-107 (**Usui et al.**). This rejection is respectfully traversed with regard to the amendments herein and the following remarks.

Burgmair et al. and Usui et al., either alone or in combination, do not disclose, teach, or suggest the gas sensor of Applicants' present claims, in which the static contact angle of the hydrophobic layer thereof, measured with water and obtained in a planar surface, is at least 105°. In addition, Burgmair et al. and Usui et al., either alone or in combination, do not disclose, teach, or suggest the gas sensor of Applicants' present claims, in which the hydrophobic layer thereof is separated from the channel area and/or the sensor electrode, and delimits the channel area and/or the sensor electrode, in a ring-like manner or a frame-like manner.

Burgmair et al. discloses a gas sensitive hybrid suspended field-effect transistor that includes: a channel; a suspended silicon gate that is positioned above the gas sensitive film, and which is separated from the channel; and a gate insulator that is fabricated from SiO_2 having a hydrophilic passivation layer of Si_3N_4 applied thereover. See, for example, the Introduction and Figure 2 of Burgmair et al.

Burgmair et al. describes the observed baseline drift of the sensor as being attributed to "the formation of a thin film of water at the surface of the passivation layer" (i.e., on the Si_3N_4 layer). See the paragraph bridging the first and second columns at page 440 of Burgmair et al. As such, Burgmair et al. discloses a hydrophilic gate insulator. Burgmair et al. further teaches that the formation of the water film, more particularly, results in the observed baseline drift, because it allows for the transport of charge carriers (i.e., ions). Burgmair et al. teaches that "these transport phenomena induced by the water film" can be prevented by heating the device "to temperatures at which condensation of liquid water at the surface does not occur." See the 5^{th} and 6^{th} full paragraphs in column 1 at page 442 of Burgmair et al.

Usui et al. disclose the formation of hydrophobic polymeric polyacrylate films by means of ionization-assisted deposition from acrylate monomer sources, such as 1H, 1H, 11H-eicosafluoroundecyl acrylate, onto glass substrates coated with aluminum films. Usui et al. disclose the polyacrylate films formed by ionization-assisted deposition of 1H, 1H, 11H-eicosafluoroundecyl acrylate monomer as having a contact angle of about 94°C (i.e., they are

hydrophobic polyacrylate films). See the abstract, the Experimental section, and the 20FAc Films section of Usui et al.

Burgmair et al. discloses a gas sensor that necessarily includes a gate insulator having an **inorganic hydrophilic** layer of Si_3N_4 over an underlying substrate of SiO_2. Burgmair et al. provides no disclosure, teaching, or suggestion with regard to a hydrophobic gate insulator or an organic coated hydrophobic gate insulator. Usui et al. disclose the formation of an **organic hydrophobic** layer of polymerized 1H, 1H, 11H-eicosafluoroundecyl acrylate monomer over a substrate of aluminum coated glass. In addition, the ionization-assisted deposition as taught by Usui et al. requires an electrically conductive substrate, such as aluminum coated glass. See, for example, Figure 1 of Usui et al. The gate insulator of Burgmair et al. is composed of a substrate of SiO_2 (which is not electrically conductive) having a layer of Si_3N_4 thereover. As such, the method of Usui et al. is not applicable to Burgmair et al., because a substrate of SiO_2 is not sufficiently electrically conductive for purposes of performing an ionization-assisted deposition process, as would be recognized by a skilled artisan. As such, neither Burgmair et al. nor Usui et al. provide the requisite disclosure that would motivate a skilled artisan to combine or otherwise modify their respective disclosures in an attempt to somehow arrive at Applicants' claimed invention.

The combination of Burgmair et al. and Usui et al. would require the initial deposition of an electrically conductive metal layer over the SiO_2 substrate of Burgmair et al., thereby converting the gate insulator of Burgmair et al. into an insulated conductor (rather than an insulator), and in effect rendering Burgmair et al. inoperable for its intended purpose, as would be recognized by a skilled artisan.

If proposed modifications render a reference inoperable for its intended purpose, then there is no suggestion or motivation to make the proposed modification, and accordingly the proposed modification would not be obvious. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Similarly, according to the MPEP, the claimed combination of references used to ground an obviousness rejection may not change the principle of operation of the primary reference or render the reference inoperable for its intended purpose. 2145(III); 2143.01.

Even if Burgmair et al. and Usui et al. were combined, Applicants' presently claimed gas sensor would not, as it could not, result from such combination as discussed in further detail previously herein.

On page 1 of the Office Action, it is argued that silicon nitride films are generally considered to be hydrophobic. Applicants respectfully disagree, and respectfully submit that this represents a mischaracterization of the relative hydrophobicity of silicon nitride layers or films. The terms hydrophobic and hydrophilic are relative terms, and in particular, terms that are relative to each other, as is recognized by a skilled artisan. In addition, a silicon nitride film has a water contact angle of 60°. See, for example, the attachment (3 pages) included herewith, entitled Kontaktwinkel. The fluorinated polyacrylate films or Usui et al. are disclosed as having a water contact angle of about 94°. See the first full paragraph in the second column on page 107 of Usui et al. A layer of silicon nitride having a contact angle of 60° would be unambiguously recognized and understood by a skilled artisan as being hydrophilic relative to a fluorinated polyacrylate film having a contact angle of over 30° higher (i.e., of about 94°), which a skilled artisan would unambiguously understand and recognize as being relatively hydrophobic.

It is respectively submitted that the remarks on page 2 of the Office Action with regard to replacement of the silicon nitride layer of Burgmair et al. with the fluorinated polyacrylate film of Usui et al. involving deposition over silicon, appear to represent a mischaracterization of Burgmair et al. Burgmair et al. discloses a passivation film that is composed of a layer of silicon nitride (Si_3N_4) over an underlying layer of SiO_2. See, page 439, left column of Burgmair et al. As such, replacing the silicon nitride layer of Burgmair et al. with the fluorinated polyacrylate film of Usui et al., as suggested in the Office Action, would appear to necessarily involve the inoperable ion assisted deposition (IAD) of a fluorinated polyacrylate film over a layer of SiO_2, which is not sufficiently electrically conductive for purposes of performing IAD, as would be recognized by a skilled artisan.

In light of the amendments herein and the preceding remarks, Applicants' claims are believed to be unobvious and patentable over Burgmair et al. in view of Usui et al. Reconsideration and withdrawal of the present rejection are respectfully requested.

II. Burgmair et al. in View of Usui et al. and in Further View of Ruther et al.

Claim 4 stands rejected under 35 U.S.C. §103(a) as being obvious and unpatentable over Burgmair et al. in view of Usui et al., and in further view of P. Ruther et al., Surface Conductivity of a CMOS Silicon Nitride Layer, Proceedings of IEEE Sensors 2003, Vol. 2, pp. 920-925 (**Ruther et al.**). This rejection is respectfully traversed with regard to the following remarks.

Burgmair et al., Usui et al. and Ruther et al., either alone or in any combination, do not disclose, teach, or suggest the gas sensor of Applicants' present claims, in which the static contact angle of the hydrophobic layer thereof, measured with water and obtained in a planar surface, is at least 105°.

Ruther et al. disclose suspended gate field transistor based gas sensors that include passivation layers composed of silicon nitride. Ruther et al. disclose that surface conduction of the silicon nitride is mediated mainly by the temperature dependent adsorption of ambient moisture. As such, the silicon nitride layers of the suspended gate field transistor based gas sensors of Ruther et al. are hydrophilic silicon nitride layers.

Usui et al. disclose the formation of an **organic** **hydrophobic** layer of polymerized 1H, 1H, 11H-eicosafluoroundecyl acrylate monomer applied by ionization-assisted deposition over a substrate of aluminum coated glass. Ruther et al. disclose suspended gate field transistor based gas sensors that include **inorganic** **hydrophilic** passivation layers composed of silicon nitride (e.g., applied over silicon). For the reasons discussed previously herein with regard to a lack of motivation to combine Burgmair et al. and Usui et al., neither Usui et al. nor Ruther et al. provide the requisite disclosure that would motivate a skilled artisan to combine or otherwise modify their respective disclosures in an attempt to arrive at Applicants' presently claimed invention. In addition and for the reasons discussed previously herein with regard to Burgmair et al. and Usui et al., a combination of Usui et al. and Ruther et al. would be similarly inoperable.

A combination of Burgmair et al. and Ruther et al. would result in a gate insulator having an inorganic hydrophilic layer of Si_3N_4 over an underlying substrate of SiO_2. As such, a combination of Burgmair et al. and Ruther et al. would not, as it could not, result in the gas

sensor of Applicants' present claims, which includes a gate insulator having a hydrophobic layer thereover.

Burgmair et al. and Usui et al. have been discussed previously herein. Ruther et al. does not serve to overcome or otherwise address the deficiencies of Burgmair et al. and Usui et al., including the lack of motivation to combine Burgmair et al. and Usui et al., or the inoperable result of such combination. As such, even if Burgmair et al., Usui et al. and Ruther et al. were combined, such combination would not result in the invention of Applicants' present claims as discussed in further detail previously herein.

In light of the amendments herein and the preceding remarks, Applicants' claims are believed to be unobvious and patentable over Burgmair et al. in view of Usui et al., and further in view of Ruther et al. Reconsideration and withdrawal of the present rejection are respectfully requested.

III. Burgmair et al. in View of Usui et al. and in Further View of Yang et al.

Claims 6 and 9 stand rejected under 35 U.S.C. §103(a) as being obvious and unpatentable over Burgmair et al. in view of Usui et al., and in further view of United States Patent No. 6,670,286 B1 (**Yang et al.**). This rejection is respectfully traversed with regard to the following remarks.

Burgmair et al., Usui et al. and Yang et al., either alone or in any combination, do not disclose, teach, or suggest the gas sensor of Applicants' present claims, in which the static contact angle of the hydrophobic layer thereof, measured with water and obtained in a planar surface, is at least 105°. In addition, Burgmair et al., Usui et al. and Yang et al., either alone or in any combination, do not disclose, teach, or suggest the gas sensor of Applicants' present claims, in which the hydrophobic layer thereof is separated from the channel area and/or the sensor electrode, and delimits the channel area and/or the sensor electrode, in a ring-like manner or a frame-like manner.

Yang et al. disclose a photopolymerization method by which a chemical microsensor film is covalently attached to an oxide surface. The covalently bonded sensing films are formed from hydrophilic materials, such as cyclodextrins, and may be used to detect

multiple analytes. See the abstract; column 3, lines 39-50; and column 5, lines 49-53 of Yang et al. Due to the plethora of hydroxyl groups, the films of Yang et al., which are formed from cyclodextrins, would be hydrophilic, as would be recognized by a skilled artisan.

Usui et al. disclose the formation of a polymerized **hydrophobic** layer of 1H, 1H, 11H-eicosafluoroundecyl acrylate monomer formed by ionization-assisted deposition over a substrate of aluminum coated glass. Usui et al. provide no disclosure, teaching, or suggestion with regard to the formation of hydrophilic layers. In addition, the ionization-assisted deposition method as disclosed by Usui et al. is limited to acrylate monomers, which form polymers by free radical polymerization, as would be recognized by a skilled artisan. Usui et al. provide no disclosure, teaching, or suggestion with regard to the ionization-assisted deposition method being applicable to cyclodextrins, which are not free radically polymerizable, as would be recognized by a skilled artisan. Yang et al. disclose the formation of a **hydrophilic** layer of cyclodextrins over an oxide surface. Yang et al. provide no disclosure, teaching, or suggestion with regard to the formation of hydrophobic layers, or the formation of layers by the *in-situ* free radical polymerization of acrylate monomers deposited on an oxide surface. As such, neither Usui et al. nor Yang et al. provide the requisite disclosure that would motivate a skilled artisan to combine or modify their disclosures so as to arrive at Applicants' claimed invention.

Burgmair et al. discloses a gas sensor that necessarily includes a gate insulator having an **inorganic** hydrophilic layer of Si_3N_4 over an underlying substrate of SiO_2. Burgmair et al. provides no disclosure, teaching, or suggestion with regard to a gate insulator having an organic hydrophilic layer (e.g., formed from cyclodextrins) over an underlying substrate of SiO_2. Yang et al. disclose the formation of an **organic** hydrophilic layer of cyclodextrins over an oxide surface. Yang et al. provide no disclosure, teaching, or suggestion with regard to the formation of an inorganic hydrophilic layer (e.g., of Si_3N_4) over an oxide surface. As such, neither Burgmair et al. nor Yang et al. provide the requisite disclosure that would motivate a skilled artisan to combine or modify their disclosures so as to arrive at Applicants' presently claimed invention. In addition, a combination of Burgmair et al. and Yang et al. would necessarily result in a hydrophilic layer, rather than a hydrophobic layer.

Burgmair et al. and Usui et al. have been discussed previously herein. Yang et al. does not serve to overcome or otherwise address the deficiencies of Burgmair et al. and Usui et al., including the lack of motivation to combine Burgmair et al. and Usui et al., or the inoperable result of such combination. As such, even if Burgmair et al., Usui et al., and Ruther et al. were combined, such a combination would not result in the invention of Applicants' present claims, as discussed in further detail previously herein.

In light of the amendments herein and the preceding remarks, Applicants' claims are believed to be unobvious and patentable over Burgmair et al. in view of Usui et al., and further in view of Yang et al. Reconsideration and withdrawal of the present rejection are respectfully requested.

CONCLUSION

In light of the amendments herein and the preceding remarks, Applicants' presently pending claims are deemed to define an invention that is unanticipated, unobvious and, hence, patentable. Reconsideration of the rejections and allowance of all of the presently pending claims is respectfully requested.

Respectfully submitted,

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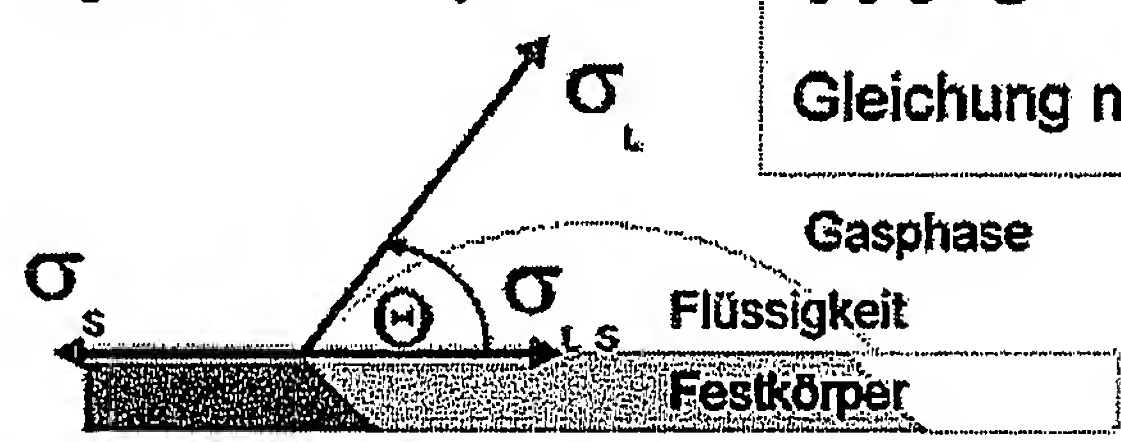
Kontaktwinkel

Methode des liegenden Tropfen



$$\cos \Theta = \frac{\sigma_S - \sigma_{LS}}{\sigma_L}$$

Gleichung nach YOUNG

σ_L = Oberflächenspannung der Flüssigkeit

σ_S = Freie Oberflächenenergie des Festkörpers

σ_{LS} = Grenzflächenenergie zwischen Flüssigkeit und Festkörper

θ = Kontaktwinkel

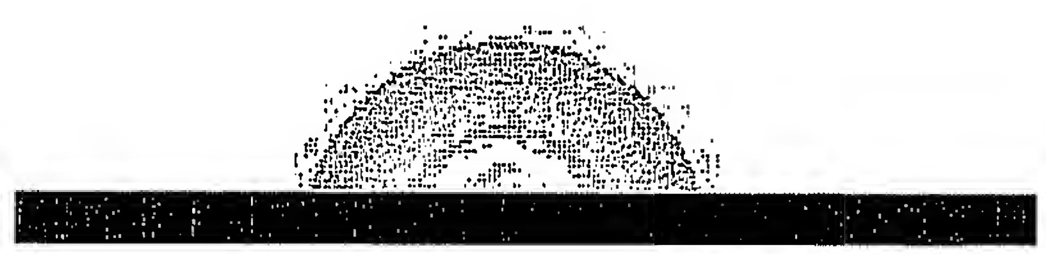
Beispiele für Kontaktwinkel

Feststoff	Behandlung	Kontaktwinkel
Siliziumnitrid	keine	60°
Siliziumnitrid	Sauerstoffplasma	6°
Objektträgerglas	keine	40°
Objektträgerglas	Piranha-Lösung (Schwefelsäure und Wasserstoffperoxid)	< 5°

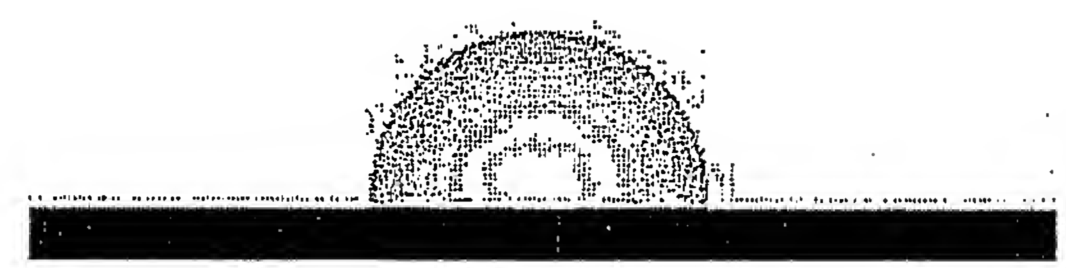
Veränderung der Kontaktwinkel

- Durch chemische Veränderungen
- Durch Physikalische (Oberflächenveränderungen)

Definition von Hydrophob und Hydrophil anhand des Kontaktwinkels

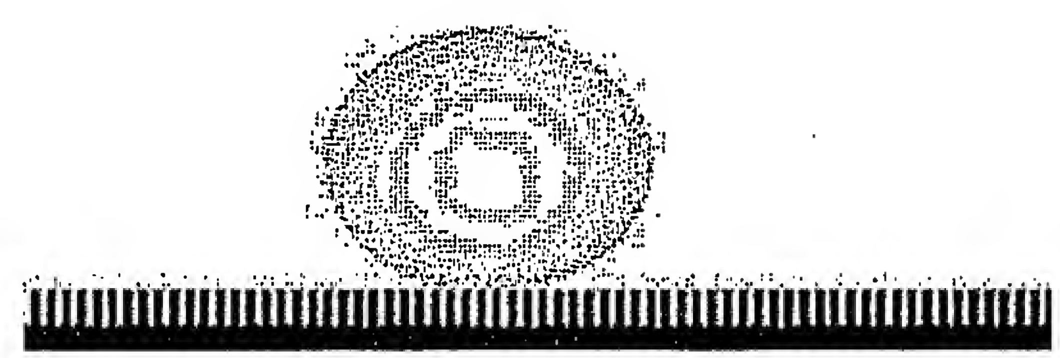


Kontaktwinkel<90°
Hydrophile Oberfläche



Kontaktwinkel>90°
Hydrophobe Oberfläche

Kontaktwinkel<90°
Hydrophile Oberfläche
mit Struktur



Kontaktwinkel>90°
Hydrophile Oberfläche
mit Struktur